Europäisches Patentamt
European Patent Office
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Patents and self-driving vehicles

Summary of key findings | November 2018

In co-operation with

eucar

Aim of the study

Self-driving vehicles (SDVs) are expected to be commercially available from 2025 and have the potential to create a transport revolution. With an estimated potential market of some several hundred billion dollars per year 2030 (A.T. Kearney, 2016), leading automotive companies are deploying massive R&D capacities to develop new technologies in this field.

A more diverse range of industrial enterprises is also becoming involved in the sector, as technology evolves in vehicles. Established automotive firms, known to be extremely innovative, must adapt to disruptive digital technologies coming from other, equally powerful industries, such as wireless communication, and big data. While the new entrants traditionally have less experience in safe vehicle design, they lead in software development, communication technologies and artificial intelligence (AI). Many of the underlying technologies have already been invented, and thousands of patent applications have been filed to secure the intellectual property rights to them.

This study provides a comprehensive picture of current trends and emerging leaders in SDV technologies. By looking at patent applications in this field, it gives a unique insight into the race to innovate in smart, connected and automated vehicles.

Drawing on the most recent patent information from the European Patent Office (EPO), including as yet unpublished patent applications, and incorporating advanced technology expertise in the field, it is a unique source of intelligence which will enable policy-makers and industry leaders to understand and anticipate the significant changes that are on the way.

About patent information

Patents are exclusive rights that are granted only for inventions that are novel, involve an inventive step and are industrially applicable. High-quality patents are assets which can attract investment, secure licensing deals and provide market exclusivity. In exchange for these temporary exclusive rights, patent applications are published, revealing the technical details of the inventions for which protection is sought.

Patent databases thus contain the latest technical information, much of which cannot be found anywhere else. The EPO's free Espacenet database contains more than 100 million documents from over 100 countries, and comes with a machine translation tool in 32 languages. Because patent applications are often published *before products appear on the market*, this information provides unique insights into disruptive technologies which will soon transform our economy.

For the purposes of this study, all technologies enabling the full automation of vehicles have been identified. The corresponding SDV patent applications have been divided into two main technology sectors, each of which is in turn subdivided into a number of SDV technology fields:

- The first sector – **Automated vehicle platform** – encompasses technologies that are embodied in the vehicle itself. It includes inventions that enable vehicles to make autonomous decisions (*Perception, analysis & decision*), inventions in the automated parts of the vehicle (*Vehicle handling*), and inventions in the underlying hardware and software technologies (*Computing*).

- The second sector – **Smart environment** – comprises technologies that enable SDVs to interact with each other and with their surroundings. It includes inventions in vehicle connectivity and related communication infrastructure (*Communication*) and inventions in traffic management, vehicle identification, automated parking and interfaces between vehicles and the electricity grid (*Smart logistics*).

Figures right side: The patent statistics are based on patent applications filed at the EPO in SDV technologies. They do not include patent applications filed with the national offices of the EPC contracting states. The reference date for each application is the filing date at the EPO.

Main findings

1. Steep rise in patent applications on self-driving vehicles at the EPO

Almost 18 000 patent applications relating to SDV technologies have been filed with the EPO in the last ten years, almost 4 000 of them in 2017 alone. Annual applications relating to SDVs increased by 330% compared with 2011, a growth rate that is more than 20 times faster than that for patent applications in general at the EPO in the same period.

Perception, analysis & decision is the largest SDV technology field, while *Communication* and *Computing* technologies have grown the fastest since 2011.

2. Patent applications in SDV involve both automotive and tech industries

The top 25 applicants together accounted for 40% of all SDV patent applications filed with the EPO, while the other 60% are held by hundreds of other technology players.

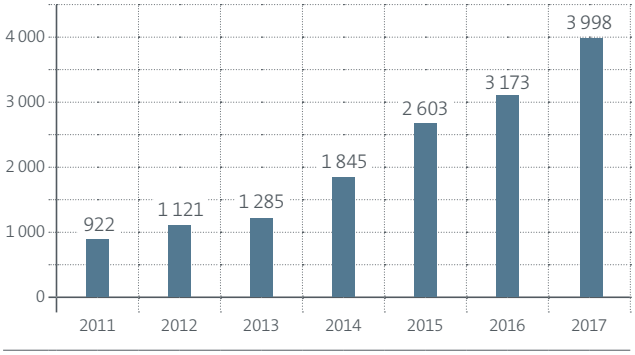
About half of the top 25 applicants operate in transport or related industries, and comprise the largest group of applicants in *Vehicle handling, Smart logistics* and *Perception, analysis & decision*. The other half consists of applicants operating in *ICT for automotive* and *Telecommunications* industries. Four large tech companies top the list of SDV applicants, due to high shares in patent applications in the *Communication* and *Computing* technology fields.

3. Europe and the USA leading the way in SDV innovation

Europe (EPC) and the USA (US) have a strong lead in SDV innovation, with about 1 400 patent applications each in 2017. European applicants stand out in the fields of *Vehicle handling*, *Smart logistics* and *Perception, analysis & decision*. US applicants dominate in *Communication* and *Computing*.

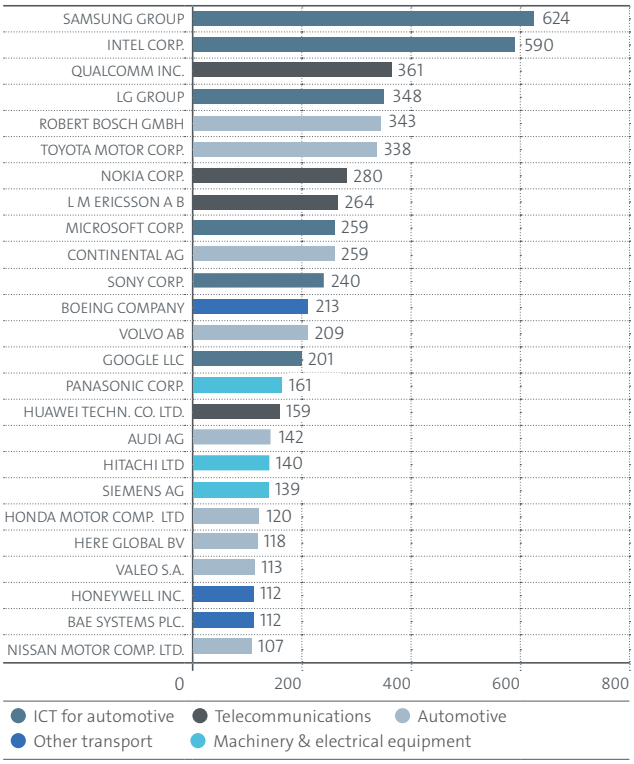
Japan (JP), the Republic of Korea (KR) and the People's Republic of China (CN) are also important innovation centres, with 468 (JP), 382 (KR) and 194 (CN) European patent applications on SDVs in 2017. Within Europe, Germany (DE) is the most active country with more than 500 SDV applications in 2017. France (FR) and Sweden (SE) also show significant innovative activity.

SDV patent applications at the EPO 2011-2017



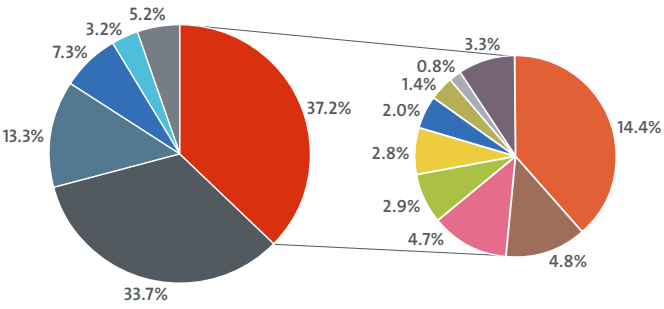
Source: EPO

Top 25 SDV applicants at the EPO 2011-2017



Source: EPO

Geographic origins of SDV applications 2011-2017



Source: EPO

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Published by the EPO
Munich, Germany

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